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Bianco

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(54) **EVSE CONTROLLER SYSTEM**

USPC 320/109
See application file for complete search history.

(71) Applicant: **James S. Bianco**, Suffield, CT (US)

(72) Inventor: **James S. Bianco**, Suffield, CT (US)

(73) Assignee: **Control Module, Inc.**, Enfield, CT (US)

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Related U.S. Application Data

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H02J 7/00 (2006.01)
B60L 11/18 (2006.01)

(52) **U.S. Cl.**
CPC **B60L 11/1824** (2013.01); **B60L 11/1838** (2013.01); **Y02T 10/7005** (2013.01); **Y02T 90/121** (2013.01); **Y02T 90/128** (2013.01); **Y02T 90/14** (2013.01); **Y02T 90/163** (2013.01)

(58) **Field of Classification Search**
CPC Y02T 90/14

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,912,753 B2 *	12/2014	Pudar et al.	320/109
2009/0079388 A1 *	3/2009	Reddy	320/109
2010/0225475 A1 *	9/2010	Karch et al.	340/540
2011/0004358 A1 *	1/2011	Pollack et al.	700/297
2011/0202217 A1 *	8/2011	Kempton	701/22
2011/0258112 A1 *	10/2011	Eder et al.	705/39
2011/029082 A1 *	11/2011	Hagenmaier et al.	320/109
2012/0229085 A1 *	9/2012	Lau	320/109
2012/0262112 A1 *	10/2012	Ross	320/109
2013/0020992 A1 *	1/2013	Wu et al.	320/109
2013/0127416 A1 *	5/2013	Karner et al.	320/109

* cited by examiner

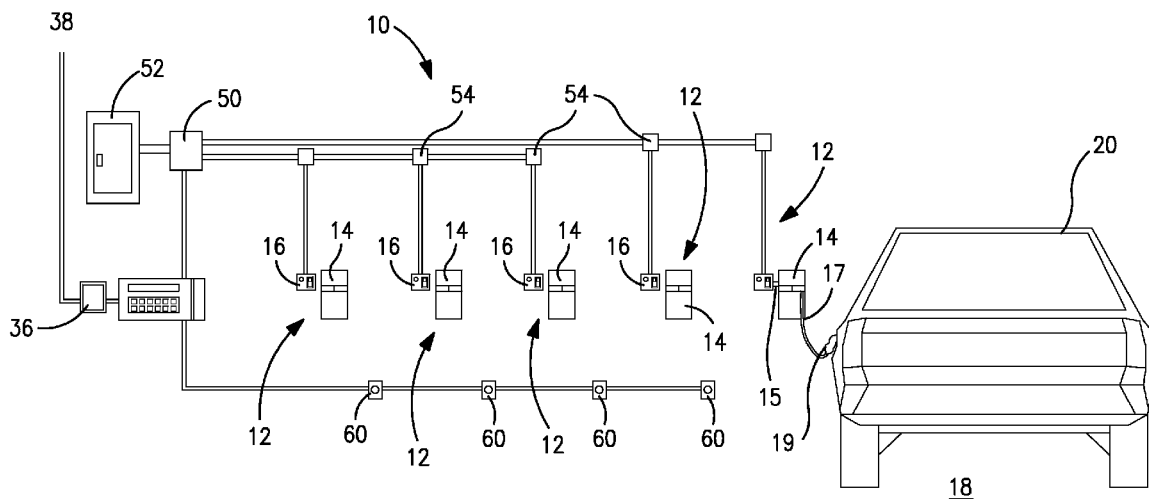
Primary Examiner — Suresh Memula

(74) *Attorney, Agent, or Firm* — Alix, Yale & Ristas, LLP

(57) **ABSTRACT**

An EVSE controller system controls the supply of power to multiple charging stations for charging electric vehicles. A controller is interposed in a power line for controlling the flow of power to each charging station. An authorization station receives input from a vehicle operator for authorizing the supply of power at a given charging station. A vehicle detector is employed to automatically sense the presence of an electric vehicle at the charging station and to automatically terminate power supply to the charging station upon departure of the electric vehicle. Both level 1 and level 2 EVSE are operated by the controller system.

20 Claims, 11 Drawing Sheets



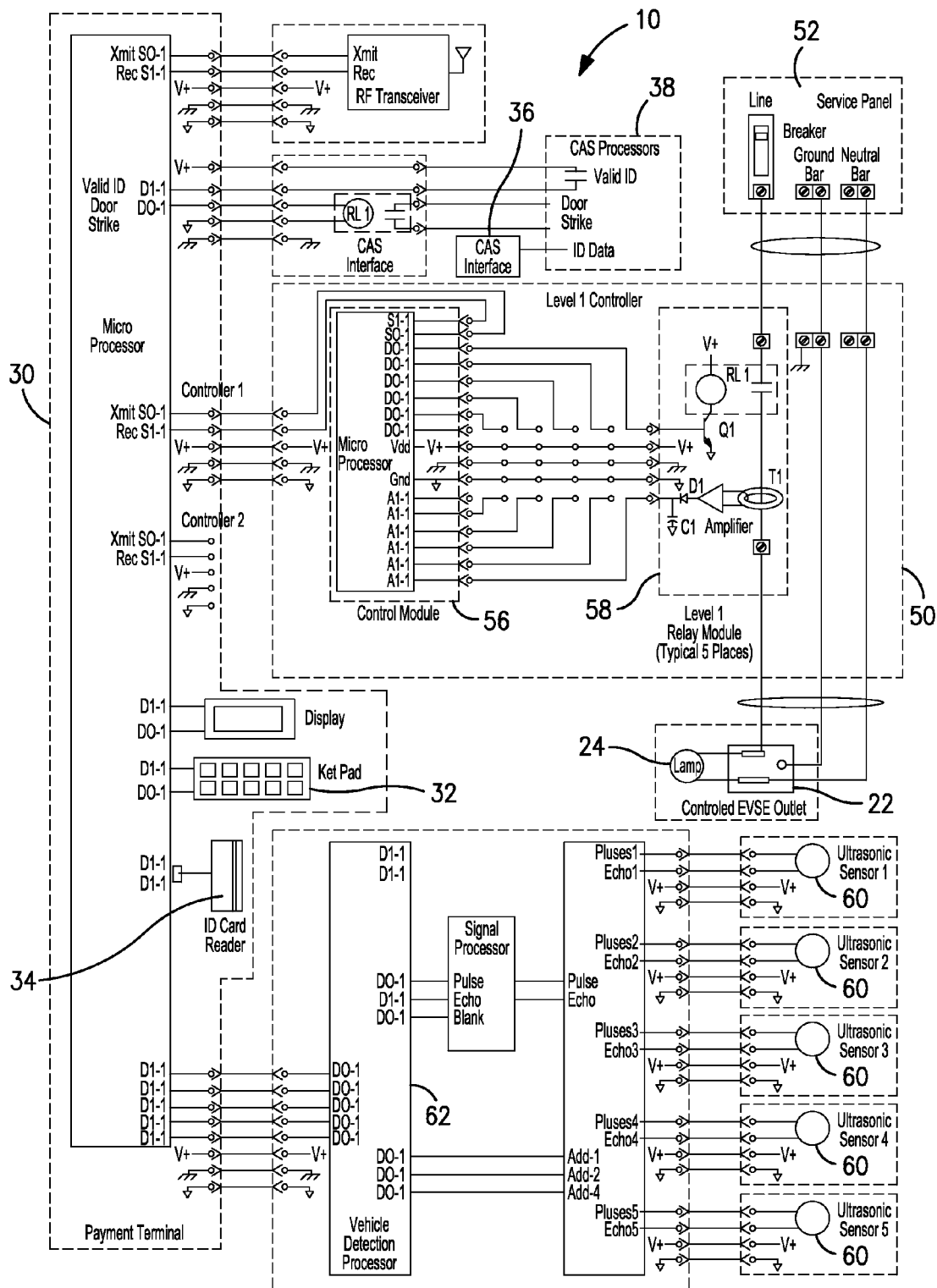


FIG. 1

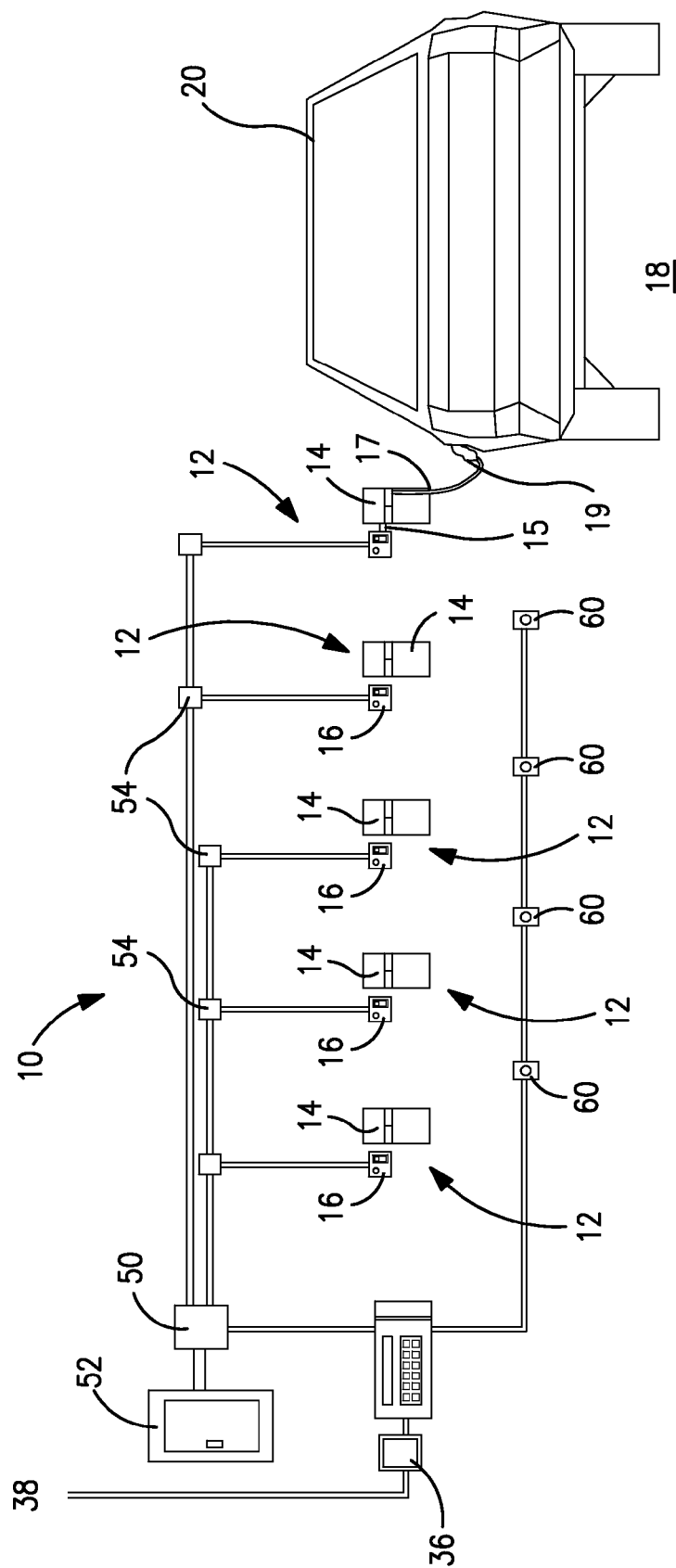


FIG. 2

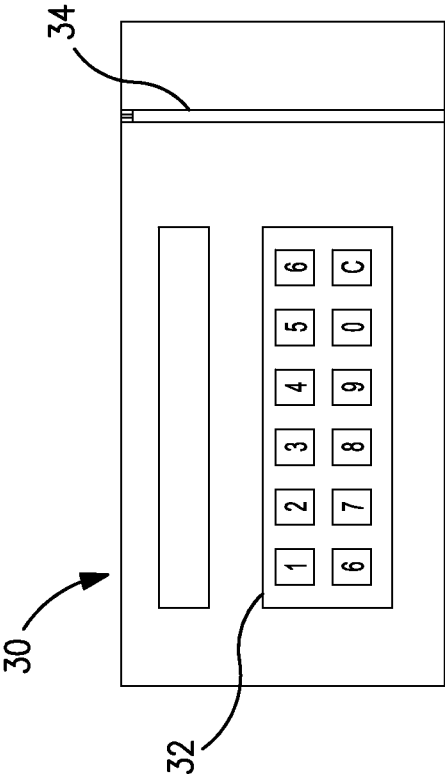


FIG. 3

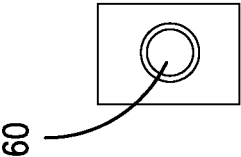


FIG. 4

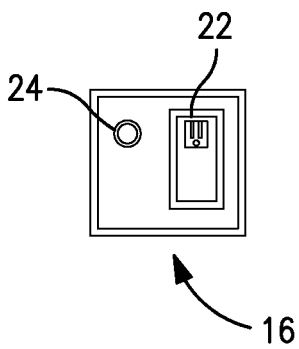


FIG. 5

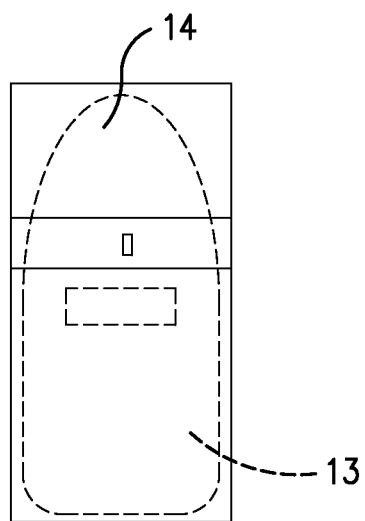


FIG. 6

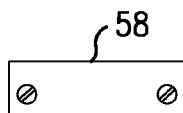


FIG. 7A

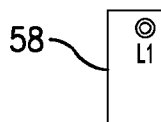


FIG. 7D

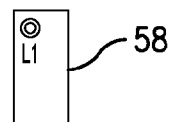


FIG. 7E

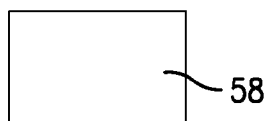


FIG. 7C

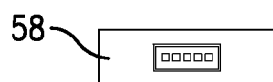


FIG. 7B

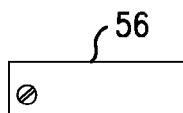


FIG. 8A

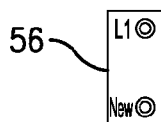


FIG. 8D

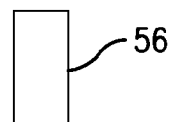


FIG. 8E

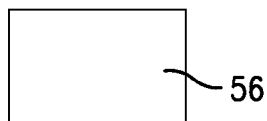


FIG. 8C

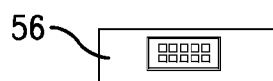


FIG. 8B

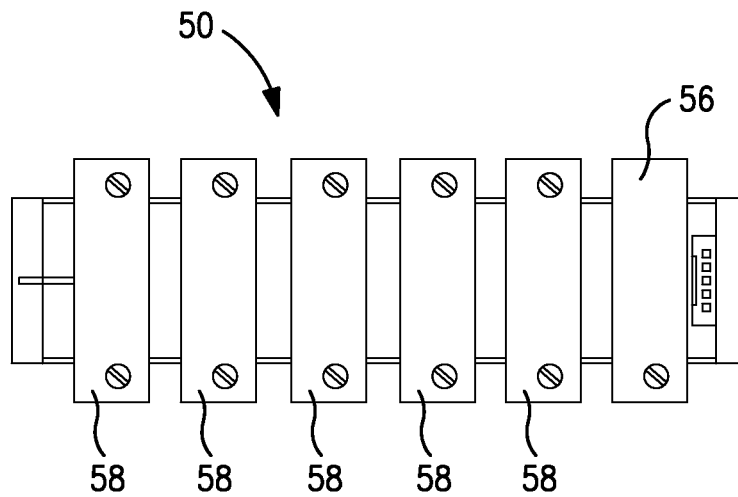


FIG. 9A

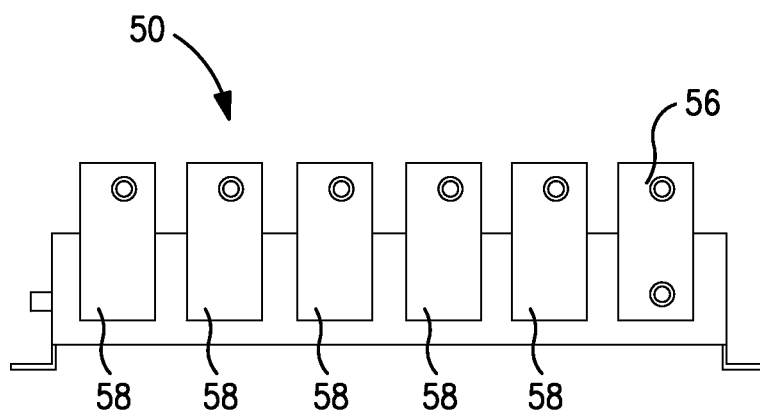
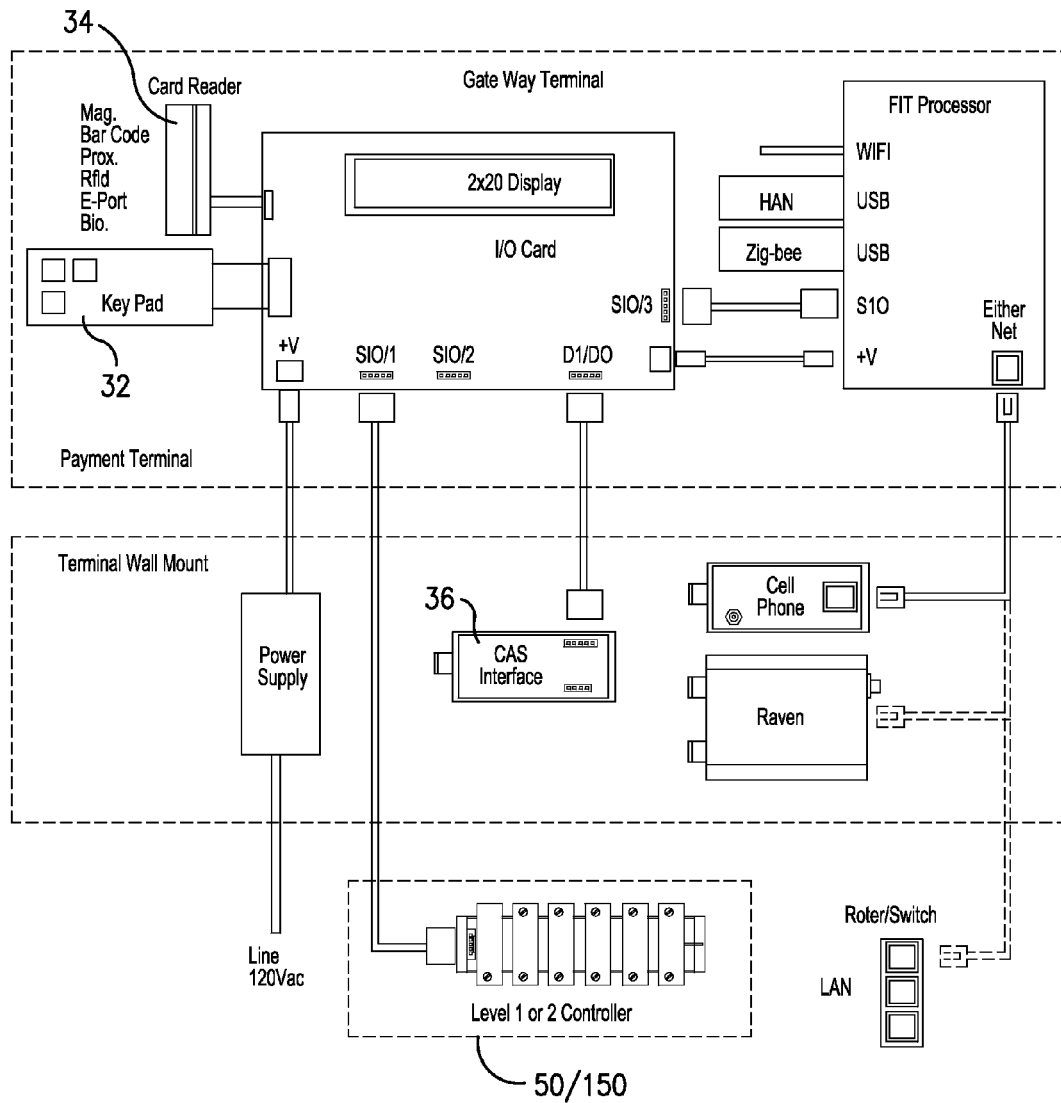
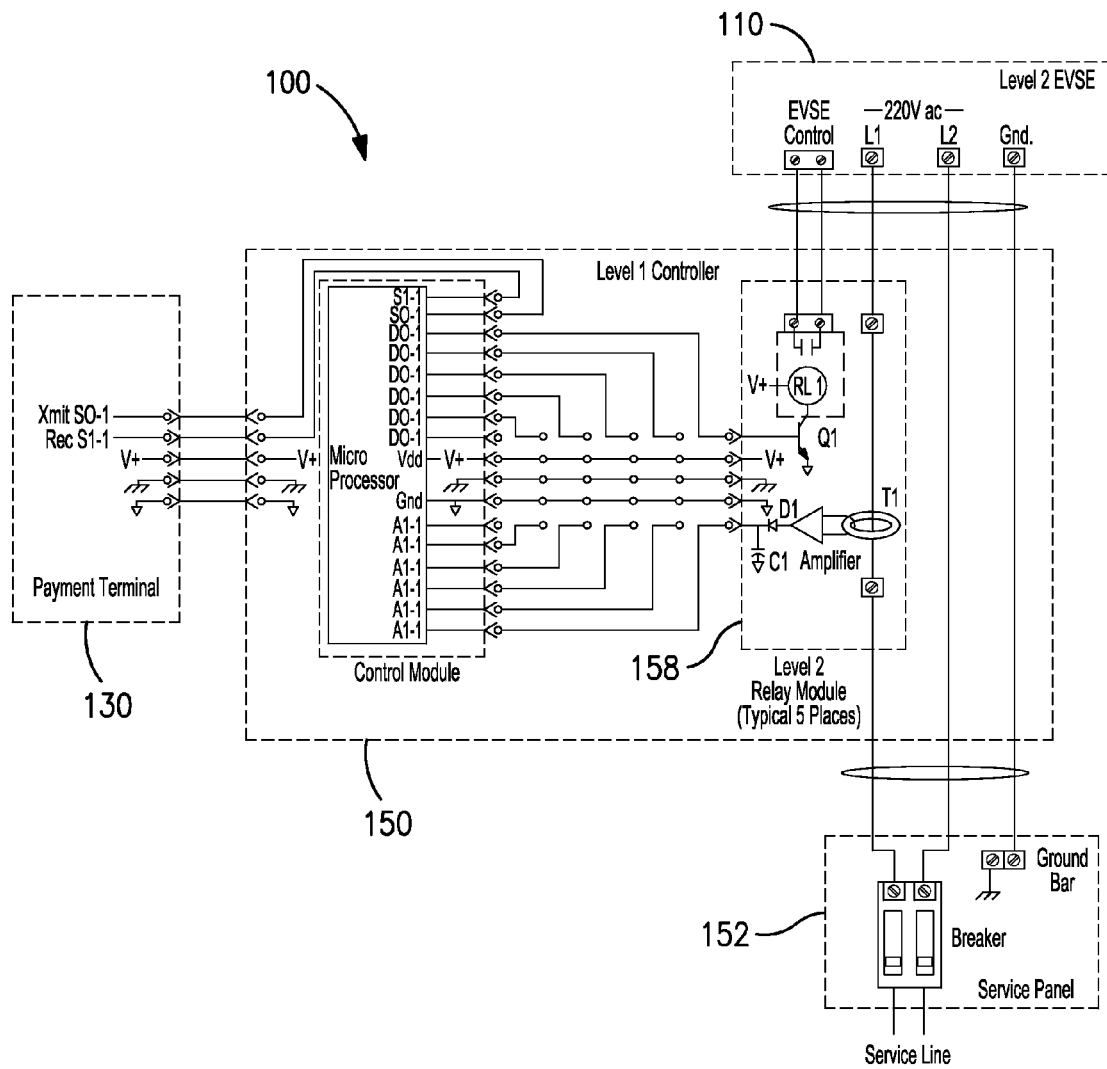


FIG. 9B

**FIG. 10**

**FIG. 11**

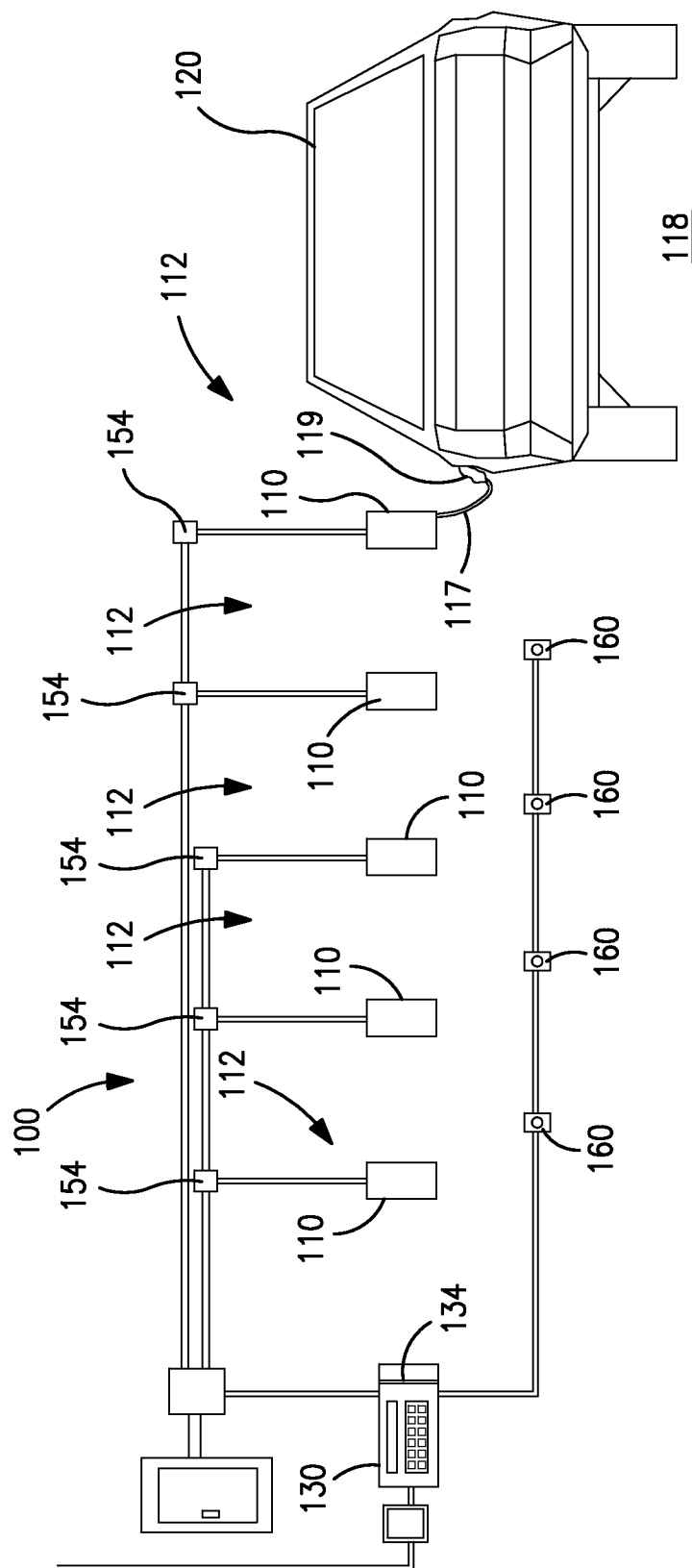


FIG. 12

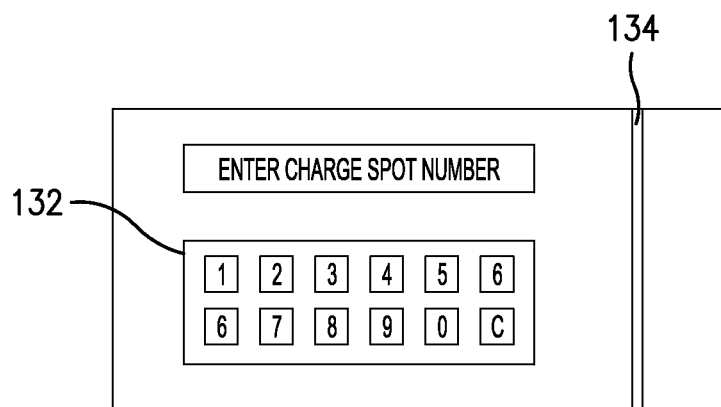


FIG. 13

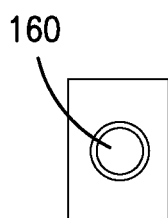


FIG. 14

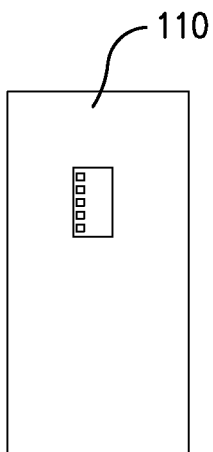


FIG. 15

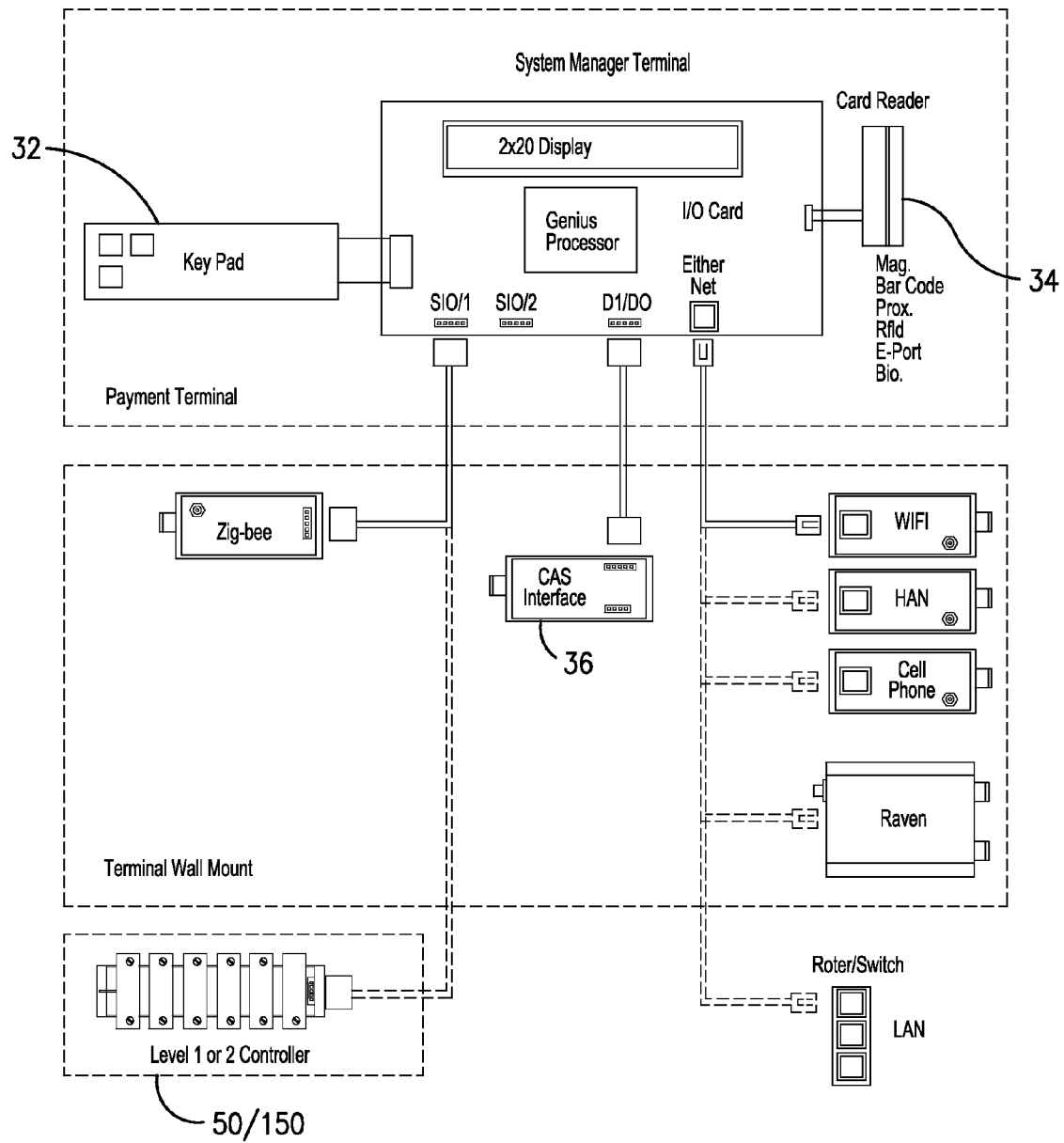


FIG. 16

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EVSE CONTROLLER SYSTEM**CROSS-REFERENCE TO RELATED APPLICATION**

This application claims the priority of U.S. Provisional Patent Application No. 61/596,365 filed on Feb. 8, 2012, the entirety of which is incorporated herein by reference.

BACKGROUND

This disclosure relates generally to electric vehicle supply equipment (EVSE) employed for charging the battery power supply of an electric vehicle. More particularly, this disclosure relates to systems for providing publicly accessible power to level 1 and/or level 2 EVSE.

A key consideration in providing publicly available electric power to charge electric vehicles is to control the supply of the power, as well as to ensure that there is a proper accounting for the power supply and that the vehicle can be charged in a safe and in a secure manner.

SUMMARY

Briefly stated, an EVSE controller system comprises an EVSE charging station having an electrical outlet and an EVSE secured receptacle, such as a lock box, adjacent the outlet. A power line supplies electrical power to the outlet. An EVSE controller is interposed in the power line for controlling the flow of power to the outlet. An authorization station receives input from a vehicle operator and provides an input to the EVSE controller. A vehicle detector detects the presence of a vehicle at the charging station. An operator input at the authorization station generates an authorization signal to the controller for processing to provide a flow of power to the station outlet. The vehicle sensor also provides a signal for terminating authorization at the EVSE controller and terminating power from the outlet if the vehicle leaves the charging station.

The vehicle detector is preferably an ultrasonic sensor. The authorization station, in one embodiment, comprises a keyboard and a reader. In one preferred embodiment, a level 1 EVSE is received in the lock box and connected to the outlet at the charging station. The EVSE has a cord extendable from the lock box which connects with the battery charging terminal of the electric vehicle.

The EVSE controller system is preferably employed for applications involving multiple charging stations. A plurality of charging stations are each connected for communication with the EVSE controller. A plurality of vehicle detectors correspond to each charging station and generate a signal for ultimately terminating authorization at the EVSE controller if a vehicle leaves the charging station.

A controller system for a level 2 EVSE comprises a charging station with a level 2 EVSE mounted in a fixed position relative to an adjacent parking space. A power line supplies power to the charging station. An EVSE controller is interposed in the power line to selectively allow power to be supplied to the charging station. An authorization station communicates with the EVSE controller. A vehicle sensor senses the presence of a vehicle at the parking space. An input provided at the authorization station generates a signal to the EVSE controller to supply power to the charging station. The vehicle sensor provides a signal so that when a vehicle is no longer detected at the parking space, the EVSE controller terminates power and authorization to the charging station.

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Multiple level 2 charging stations are preferably employed. The vehicle detector is preferably an ultrasonic detector and there is a vehicle detector for each of a plurality of parking spaces, each associated with a charging station. A plurality of charging stations each with a level 2 EVSE are connected for receiving power through the EVSE controller. In one embodiment, the authorization station comprises a keyboard which has keys corresponding to or designating various parking spaces for the charging stations.

A method for charging an electric vehicle comprises inputting information to authorize the usage of electric power at a charging station and controlling the supply of power at the charging station in response to the authorization. An electric vehicle is connected to receive power supplied at the charging station. The method includes detecting the presence of the electric vehicle at the charging station, charging the battery power supply of the electric vehicle and terminating the power supplied to the charging station upon no longer sensing the presence of the electric vehicle at the charging station.

The method further comprises placing the EVSE in a secured enclosure, connecting the EVSE to the electric vehicle and charging the battery power supply of the vehicle upon proper authorization.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a controller system for a level 1 EVSE;

FIG. 2 is a schematic view of the level 1 EVSE controller system of FIG. 1 as incorporated into a multiple station installation for charging an electric vehicle;

FIG. 3 is a front view of a payment terminal for the controller system of FIG. 1;

FIG. 4 is a front view of an ultrasonic sensor for a vehicle detector for the controller system of FIG. 1;

FIG. 5 is a front view of an EVSE outlet for the controller system of FIG. 1;

FIG. 6 is a front view of an EVSE lock box with a level 1 EVSE (shown in phantom) employed in the controller system of FIG. 1;

FIGS. 7A-7E are front, rear, top and side views of a relay module employed in the controller system of FIG. 1;

FIGS. 8A-8E are front, rear, top and side views of a control module employed in the controller system of FIG. 1;

FIGS. 9A and 9B are a top and a side view of a level 1 EVSE controller employed in the controller system of FIG. 1;

FIG. 10 is a block diagram for a gateway terminal incorporating either a level 1 or level 2 controller;

FIG. 11 is a schematic diagram of a controller system for a level 2 EVSE;

FIG. 12 is a schematic view of a controller system for a level 2 EVSE as incorporated into a multiple station installation for charging an electric vehicle;

FIG. 13 is a front view of a payment terminal for the controller system of FIG. 12;

FIG. 14 is a front view of an ultrasonic sensor employed in a vehicle detector for the controller system of FIG. 12;

FIG. 15 is a front view of a level 2 EVSE employed in the controller system of FIG. 12; and

FIG. 16 is a block diagram of a system manager terminal which incorporates either a level 1 or level 2 EVSE controller system.

DETAILED DESCRIPTION

With reference to the drawings wherein like numerals represent like parts throughout the several figures, a controller

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system for a level 1 EVSE is generally designated by the numeral **10**. Controller system **10** is incorporated into numerous substantially identical stations designated by the numeral **12**. Each station **12** includes an EVSE secured receptacle, such as a lock box **14**, which is dimensioned for receiving a level 1 EVSE **13** (only one illustrated). The lock box **14** is mounted in a fixed position adjacent a power outlet **16** positioned in close proximity to a parking space **18**. The level 1 EVSE **13** includes a short cord **15** which extends through the lock box **14** for connection with the power outlet **16** of the station. The EVSE power cord **17** also extends from the lock box **14** and includes a connector **19** which connects with the terminal of the battery power supply of the electric vehicle **20**.

Preferably, there are multiple charging stations **12** (five illustrated in FIGS. **1** and **2**) disposed in side-by-side relationship. Each power outlet **16** includes a 120 VAC controlled outlet **22** and an LED lamp **24** which indicates that power is supplied to the outlet.

An authorization or payment terminal **30** preferably services all of the charging stations. The payment terminal **30** includes a keyboard **32** for entering the charge station or parking space number, and in some applications, a pin or customer number. The payment terminal also includes a slot for an ID card reader **34** for entering a charge card or an authorization card. The payment terminal connects via a controlled access system (CAS) module **36** which connects with a CAS processor **38** at a remote location.

A level 1 EVSE controller **50** connects with the electrical service panel **52** which provides electric power to each of the junction boxes **54** for connection with each of the EVSE outlets **16**. The level 1 controller **50** includes a control module **56** with a microprocessor and a relay module **58**. The relay module **58** selectively controls power to the EVSE outlet **22**. The controller **50** communicates with the terminal **30** and receives authorization input signals to allow the supply of power to a charging station **12** selected at the terminal **30**.

Each parking space **18** includes a vehicle detector, preferably in the form of an ultrasonic sensor **60**. Each ultrasonic sensor **60** detects the presence of the vehicle at the corresponding parking space and provides an input to a vehicle detection processor **62**. The processor **62** communicates via the payment terminal **30** to the level 1 EVSE controller **50**. The vehicle detector **60** functions so that when the vehicle leaves the parking space (the presence signal ceases), the power supply is terminated by the EVSE controller **50** until a new input which authorizes the supply of power to the specific station (which may be selected at the keyboard **32** or a reader at the payment station) is provided.

It will be appreciated that the level 1 EVSE **13** is placed in and secured by the lock box **14**. The level 1 EVSE is typically supplied by the vehicle owner. The lock for the lock box **16** is also typically supplied by the vehicle owner.

With reference to FIGS. **11** and **12**, a controller system for a level 2 EVSE is generally designated by the numeral **100**. Permanently mounted level 2 EVSE designated generally by the numeral **110** are provided at each of the charging stations **112**. Each charging station has an associated parking space. Each EVSE **110** includes a cord end **117** with a J1772 connector **119** for connecting with the battery charging terminal of the electric vehicle **120**.

The payment station **130** also includes a keyboard **132** for entering the parking space number, as well as a card reader **134**. A CAS module **136** may also be included. The payment station **130** communicates with a level 2 controller **150**. The payment or authorization station **130** provides input to the controller **150** for authorizing the supply of power for a selected charging station **112**.

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An ultrasonic or other vehicle sensor **160** is provided for each of the parking spaces. Vehicle sensor **160** generates a presence signal input via the payment station **130** to the level 2 EVSE controller **150**. The EVSE controller **150** connects with the electric service panel **152** to supply power to the junction boxes **154** for connection with each of the EVSE **110**. When the vehicle leaves the parking space **118**, the ultrasonic sensor **160** transmits a signal (ceases generating a presence signal) which ultimately causes the EVSE controller **150** to terminate the supply of electric power to the specific EVSE **110**. Typically 220 volt AC power is delivered and is controlled by a relay **158** in the level 2 EVSE controller **150**.

It will be appreciated that either the level 1 controller **50** or the level 2 EVSE controller **150** can be readily incorporated into either a gateway terminal such as illustrated in FIG. **10** or a system manager terminal such as illustrated in FIG. **16**. The level 1 or level 2 controller is merely a plug in module which is connected to either the input/output card of the gateway terminal of the Genus® processor. All of the other features, such as connection to the Ethernet, of the gateway terminal and the assistant manager terminal can be effectively exploited and employed in connection with either the level 1 controller **50** or the level 2 EVSE controller **150**.

The invention claimed is:

1. An EVSE controller system comprising:

an EVSE charging station comprising an electrical outlet and an EVSE secured receptacle adjacent said outlet; a power line connected to supply electrical power to said outlet;

an EVSE controller interposed in said power line for selectively controlling the flow of power to said outlet; an authorization station configured to receive input from a vehicle operator and provide an authorization input to said EVSE controller;

a vehicle detector for detecting the presence of a vehicle at said charging station,

wherein an operator input at said authorization station generates an authorization signal to said controller to provide a flow of power to said station outlet, and said vehicle sensor provides an input for terminating authorization at said EVSE controller if said vehicle leaves said charging station.

2. The controller system of claim **1** wherein said vehicle detector is an ultrasonic sensor.

3. The controller system of claim **1** wherein said authorization station comprises a keyboard and a reader.

4. The controller system of claim **1** wherein said secured receptacle is a lock box and further comprising a level 1 EVSE received in said lock box and connected to said charging station outlet and having a cord extendable from said lock box for connecting with the battery charging terminal of an electric vehicle.

5. The controller system of claim **1** further comprising a plurality of charging stations each connected to said EVSE controller and a plurality of vehicle detectors corresponding to each charging station and communicating with said authorization station for terminating authorization at said EVSE controller if a vehicle leaves said charging station.

6. The EVSE controller system of claim **1** further comprising an LED lamp which indicates that power is supplied to said outlet.

7. The EVSE controller system of claim **1** wherein said authorization station includes an input module for entering a specific parking space identification.

8. The EVSE controller system of claim **1** wherein said authorization station comprises a card reader.

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9. The EVSE controller system of claim 1 wherein said authorization station further comprises a controlled access module.

10. A controller system for a level 2 EVSE comprising:
 a charging station comprising a level 2 EVSE mounted in a
 fixed position relative to an adjacent parking space;
 a power line connected to supply power to said charging
 station;
 an EVSE controller interposed in said power line for selec-
 tively allowing power to be supplied to said charging
 station;
 an authorization station communicating with said EVSE
 controller;
 a vehicle sensor for sensing the presence of a vehicle at said
 parking space,
 wherein an input at said authorization station generates a
 signal to the EVSE controller to supply power to said
 charging station, and said vehicle sensor provides a sig-
 nal so that when a vehicle is no longer detected at said
 parking space, said EVSE controller terminates power to
 said charging station.

11. The controller system of claim 10 wherein said vehicle detector is an ultrasonic sensor.

12. The controller system of claim 10 and further compris-
 ing a plurality of charging stations, each with a level 2 EVSE
 and each connected for receiving power via said EVSE con-
 troller.

13. The controller system of claim 10 wherein said autho-
 rization station comprises a keyboard with keys identifying or
 entering the identification of various parking spaces corre-
 sponding to said charging stations.

14. The EVSE controller system of claim 10 further com-
 prising an LED which indicates that power is supplied to said
 EVSE.

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15. The EVSE controller system of claim 10 wherein said authorization station includes an input module for entering a specific parking space identification.

16. The EVSE controller system of claim 10 wherein said authorization station comprises a card reader.

17. A method for charging an electric vehicle comprising:
 inputting information to authorize the usage of electric
 power at a charging station;

controlling the supply of power at said charging station in
 response to the authorization;

connecting an electric vehicle to supply power at said
 charging station;

automatically detecting the presence of the electric vehicle
 at the charging station;

charging the electric vehicle at said charging station; and
 automatically terminating the supply of power to said
 charging station upon sensing the electric vehicle has
 left the charging station.

18. The method of claim 17 further comprising:

connecting an EVSE to power at a charging station;

placing the EVSE in a secured enclosure;

securing the EVSE in the enclosure; and

connecting the EVSE to the battery charging terminal of
 the electric vehicle.

19. The method of claim 17 further comprising selecting a
 specific charging station and inputting information to autho-
 rize the usage of electric power at the selected charging sta-
 tion.

20. The method of claim 19 wherein the step of inputting
 information further comprises reading a card.

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